

THE NAUTILUS

Vol. 73

JULY, 1959

No. 1

A NEW *BERINGIUS* FROM THE PACIFIC NORTHWEST WITH COMMENTS ON CERTAIN DESCRIBED FORMS

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During the last year and a half more than a dozen specimens of a large *Beringius* have been obtained from Mr. Everett C. Stiles of Bellingham, Washington; these were taken by trawl fishermen operating off the Washington coast. Loan of these to the California Academy of Sciences for study has prompted a review of available specimens under the names *Beringius crebricostatus* Dall, *B. crebricostatus undatus* Dall, and *B. kennicotti* Dall. These include shells furnished by the U. S. National Museum, among them the type of *B. c. undatus*, through the courtesy of Dr. Harald Rehder; by the Stanford University Department of Mineral Sciences from Dr. Myra Keen; by the San Diego Society of Natural History from Mr. E. P. Chace; and several specimens from the private collections of Messrs. Walter J. Eyerdam, of Seattle, and John Q. Burch, of Los Angeles.

One obvious problem in studying shells of the genus *Beringius* is the relative scarcity of material. One must, at present at least, draw conclusions on but few specimens, often only a single one from a given locality. Many are beach-worn or damaged, or are not sufficiently full grown to show adult characters well. But even under these difficulties it seems possible to draw some tentative conclusions about certain described forms for the benefit of others who may desire to pursue the problem further upon acquisition of more and better material.

The shells now before me, with others seen and studied, present a puzzling array. Identification of them with described and figured species is difficult and can be only tentative in view of the wide variation in sculptural characters and in the shape aspects of the shells. There appear to be four more or less distinct categories represented by *Beringius* shells with heavy spiral ribbing as follows:

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1. Fairly long-spired shells with strong spiral ribs and relatively little or no evidences of transverse ribbing or plications. Numbers of major spirals range from 8-14 on the body whorl and 3-6 on the earlier postnuclear whorls. *B. crebricostatus*

2. Fairly long-spired shells with more numerous and less strong spiral ribs and prominent transverse ribs or plications. On the body whorl the spirals may be continuous over the entire area, or may be strong only below the periphery and weak or sub-obsolete above it. Numbers of major spirals are 8 or more on the postnuclear whorls. The transverse ribs or plications range in number from 12-15 per whorl. *B. kennicotti*

3. Shells similar to "2," preceding, but transverse ribbing much weaker and sometimes obsolete. *B. undatus*

4. Shells with spiral sculpture similar to "2," preceding, but with shorter spire, more tabulate whorls, extremely deep sutures, and a more tumid body whorl. *B.*, new species

In all specimens seen the canal is short and, if not worn or broken, has a series of weaker, closely spaced ribs on it ranging from 5-9 in number. Although a well-marked fasciole is sometimes present, generally it is weak or absent.

The line of demarcation between *B. crebricostatus* and *B. kennicotti* is fairly distinct; but between *B. kennicotti* and *B. undatus* it is much less so. In fact, with more and better material than is now available, these latter two species possibly can be merged into a single variable species. Based on the shells at hand, *B. crebricostatus undatus* Dall, 1919, seemingly is wrongly placed and should stand, at least for the time being, as a separate species more closely related on sculptural criteria to *B. kennicotti* than to *B. crebricostatus*.

BERINGIUS CREBRICOSTATUS (Dall), 1887.

Pl. 1, fig. 1

This is the type species of the genus and has been well figured. Sculpture consists of heavy, flat-topped, spiral ribs, separated by deeply channeled interspaces. The ribs are "swaged" at the summits so as to overhang the interspaces slightly. While the original description and figure indicate 3 of these revolving ribs occur on the penultimate and earlier postnuclear whorls, a beach-worn and damaged specimen in the Stanford Collection (No. 7213) from Simeonof Island, Alaska, has 6 revolving ribs but is typical otherwise. Another Stanford shell from Unalaska, the type locality, is illustrated on plate 1, fig. 1. It has 4 prominent spiral ribs on the penultimate whorl with a 5th weak one just below the upper

suture; the earlier whorls have 3 ribs, with a weaker one just above the lower suture. In this shell, the channeled interspaces are much wider than the spiral ribs. The approximate number of spiral ribs on the body whorl is given as 14 in the original description but on the two Stanford specimens it is 13 and 14, respectively.

Related to *B. crebricostatus* is a fine adult specimen collected alive off British Columbia in 238 fathoms (U.S.N.M. No. 210299, U.S.F.C. Sta. 2862). This has 6 spiral ribs on the early post-nuclear whorls and about 19 on the body whorl and canal. In this shell, the ribs are much narrower than the channeled interspaces and are less prominent overall than in the typical form.

In *B. crebricostatus*, evidences of broad transverse ribbing across the whorls are slight, and this feature seems not to apply to the species when compared with *B. kennicotti*. Evidently one also must allow for considerable variation in the number of spiral ribs, their relative prominence, and their widths compared with the corresponding widths of the adjacent channeled interspaces. In general, the species has a comparatively long-spined shell, the length of the spire being about equal to or greater than the length of the aperture and canal. Such measurements should, of course, make proper allowance for missing nuclear whorls as these are often lost or damaged.

If the above allowances for sculptural variation are correct, the range of the species is extended from the Aleutians south at least to a position off the British Columbia coast. Thus it overlaps the ranges of other forms to be considered.

"COLUS" PERISCELIDUS Dall, 1891.

The National Museum type lot consists of two fine specimens, No. 122643, U. S. Fish Commission Station 2842 off Akutan Islands, Aleutians. As has long been suspected these shells, which are now before me, have the characters of a diminutive *Beringius* belonging to the group of *B. crebricostatus*. Placement in the genus *Colus* is questionable. The two specimens in the type lot are almost identical in measurements but only one has a perfect lip. McConnell's drawing in the Proc. U. S. Nat. Mus. 17, 1894, pl. 27, fig. 6, is an excellent representation. Another somewhat smaller specimen in the collection of the U. S. Geological Survey

(No. D 397) from Lash Bay, Tanaga Island, Andreanof Group, Aleutians, has the tops of the spiral cords "swaged" so as to overhang the adjoining channels, as in typical shells of *B. crebri-costatus*.

BERINGIUS KENNICOTTI (Dall), Pl. 1, figs. 2 and 3.

Two specimens that conform to the general requirements of this species are in the Stanford University Collection. One (No. 929-1) comes from Petersburg, Alaska; the other (No. 7215, old no. 929-2) from Kodiak Island, Alaska. These are illustrated on pl. 1, figs. 2 and 3. Both have about the same numbers of spiral ribs on the body whorl and canal (23 and 26, respectively); each has 10 spirals on the earlier whorls. The transverse rib count on the last three whorls, starting with the body whorl is 12 - 15 - 15 for the Petersburg shell and 13 - 14 - 13 for the specimen from Kodiak Island. These transverse ribs or plications are strong above the periphery of the body whorl but become gradually weaker below it in both specimens. The major difference between the two specimens lies in the fact that the spiral ribs on the body whorl are strong throughout on the shell from Kodiak Island, whereas on the shell from Petersburg these are extremely weak from the summit of the whorl to a point just below the periphery where they become equal in strength to those on the Kodiak shell. This difference in sculpture is liable to be confusing unless allowance is made for it in relating single specimens to this particular species.

B. kennicotti incisus Dall, 1907, has not been seen by the writer but is believed to be another sculptural variant.

BERINGIUS UNDATUS Dall, 1919. Pl. 1, figs. 4 & 5, pl. 2, figs. 1 & 2.

The type specimen is figured here for the first time on pl. 1, figs. 4 and 5. It is U.S.N.M. No. 223031 and comes from 160 fathoms, mud, off Cygnet Inlet, Boca de Quadra, southeast Alaska (U.S.F.C. Sta. 4224). As stated, it is a relatively young specimen and contains the operculum. The number of transverse plications on the body whorl is 17, which is larger than average, the range in other specimens studied being 12-14.

The transverse plications in some specimens of *B. undatus* are relatively weak and difficult to count with accuracy. Because these do not appear to be a major sculptural feature of the spe-

cies there seems good reason to make a generic distinction between it and *B. kennicotti*. Considering the possible limits of sculptural variation in shells of the genus, however, the relationship between the two nominal species is admittedly close and we may be dealing with a single polymorphic species. Specimens studied, that are considered to belong to *B. undatus*, are as follows:

1. A single specimen dredged to the north of Unimak Island, Aleutians, in 41 fathoms, sand (U.S.N.M. No. 122718, U.S.F.C. Sta. 3259). This is a fairly large, heavy-textured, thick-lipped shell 115 mm. long, taken alive. Spiral ribbing is strong throughout, there being 21 on the body whorl and seven each on the two preceding whorls. Transverse plications are weak, the numbers on the last three whorls being 11-12-13, respectively, starting with the body whorl.

2. The type specimen from Boca de Quadra, southeast Alaska, and another smaller specimen from the same general locality and depth (U.S.N.M. No. 222589, U.S.F.C. Sta. 4225).

3. A single large, full grown specimen, 143 mm. long, from off Masset, British Columbia, in the Stanford Collection (No. 7214). This shell is illustrated on pl. 2, figs. 1 and 2. Numbers of spiral ribs on the last three whorls are 18-9-9, starting with the body whorl. The canal has a series of 9 ribs. The channeled interspaces are not as deeply cut as in most of the other shells of this species that have been studied. Transverse plications are fewer than average and number 12-12-11 on the last 3 whorls. The shell is well preserved but not collected alive.

4. Two specimens in the Stanford Collection (No. 7214) from off the San Juan Islands, Puget Sound, Washington, in 25-30 fathoms. These are labeled "*B. crebricostatus* var. *undatus* Dall (1919)" in Dall's handwriting. One is an imperfect, full grown "dead" shell; the other is a young one with the nuclear tip complete.

5. A single young shell, dredged off Flat Point, Lopez Island, Puget Sound, in the California Academy of Sciences Paleo. Collection (No. 34789), illustrated on pl. 2, fig. 6.

BERINGIUS EYERDAMI, new species Pl. 2, figs. 3, 4; Pl. 3, figs. 1-4.

The specimens from Messrs. Stiles and Eyerdam differ markedly from other species with heavy spiral ribbing and seem worthy of a new name.

Holotype: Shell an adult specimen, large (about 4½ inches long), of fairly heavy texture, globose, creamy-white, covered in places with a thin, golden-brown periostracum. Nuclear whorls missing; postnuclear whorls about 4½, well-rounded, tabulate

at the summits, with fairly deep sutures. Body whorl tumid, constricted at the base to form a short but wide, relatively straight siphonal canal. Axial sculpture faint, consisting of a series of broad, low irregular, widely-spaced, undulating plications, more evident on the upper portions of the postnuclear whorls but fading out almost entirely on the body whorl. Spiral sculpture prominent and strong over all postnuclear whorls, consisting on the first of 6, on the next of 7, and on the body whorl of 15 heavy, square-cut, revolving ribs bounded by narrower but deep, square-cut channels that are concave at their bottoms; both spiral ribs and their interspaces widen gradually as they approach the outer lip of the aperture, which is crenulated inside to correspond with the heavy outside spiral sculpture. Outside of canal worn, devoid of ribbing in the holotype. Over-all microsculpture consisting of close, irregularly placed, growth riblets that continue over the spiral ribs and into the channeled interspaces. Major spiral ribs on the body whorl generally cut by one, centrally placed, weak, incised line and sometimes by more still weaker ones. Aperture capacious, subovate, of a pinkish color inside; outer lip thick, not flaring; inner lip appressed, consisting of a heavy wash of callus; columella slightly curved. Canal wide, short and relatively straight. Just inside the mouth of the shell on the upper side of the inner lip is a broad, low, rounded, raised area or boss. Operculum thick and coarse, normal for the genus. Animal (in alcohol) a female, the upper portion of the mantle yellowish-white, lightly dusted with irregular, light gray maculations; edge of mantle incised and ribbed corresponding with the outside sculpture of the shell, the ribs marked with red-brown for a distance of about 5 mm. back of the edge. Dimensions of shell in mm.: length, 113.9; maximum diameter, 74.8; maximum width of aperture, 37.7; length of aperture and canal, 75.0; length of canal alone, approximately 23.5 mm.; number of postnuclear whorls, $4\frac{1}{2}$.

Locality and disposition of specimens: Dredged at various times in 1957 and 1958 by the trawlers "Cooledge II," "Karen," "Northern Light," and "Paul L." in approximately 100 fathoms on La Perouse Bank about 40 miles off Cape Flattery opposite the entrance to the Strait of San Juan de Fuca, Washington. Holotype in the Calif. Acad. Sci. Paleo. Type Coll. (C.A.S. no. 36318). A total of 14 paratypes from the same general locality have been designated as follows: 2 in Calif. Acad. Sci. Paleo. Type Coll.; 8 in the collection of Mr. E. C. Stiles; one in the collection of Mr. Walter J. Eyerdam; 3 in the collection of Mr. John Q. Burch; and one in the collection of the San Diego Society of Natural History.

Geographical Range: Chignik, Alaska (Norberg) to the coast of Washington in about 100 fms. off the Strait of San Juan de

Fuca (Stiles); Puget Sound, Washington (Eyerdam).

Remarks: Because so many specimens of a large, deepwater *Beringius* are available for study at one time, somewhat detailed comments on the range in variation of the shells seems pertinent. The total number at hand or otherwise known is as follows:

The holotype and 14 paratypes, from the type locality, obtained by Mr. Stiles. The paratypes include 3 kindly loaned by Mr. and Mrs. Burch and one supplied by Mr. Eyerdam, who also furnished the holotype. An additional specimen (topotype) is stated to be in the collection of Mrs. Elizabeth Phelps, Delray Beach, Florida, has not been available for study.

A single shell (paratype) in the museum of the San Diego Society of Natural History (No. 12917) from off Vancouver Island, British Columbia.

Two shells obtained by Mr. Ingvar Norberg at Chignik, Alaska, one of which is in Mr. Eyerdam's collection and the other said to be in the Tromsø Museum, Norway. The latter of these has not been studied.

A single shell collected by Mr. Eyerdam during seine operations for herring in 1945 at Raspberry Island, Kodiak Island Group, Alaska.

A single full-grown but "dead," worn specimen collected by Mr. Eyerdam in Puget Sound at Restoration Point, Bainbridge Island, Kitsap Co., Wash.

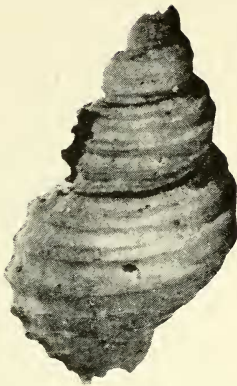
Comments on these follow in the order listed.

Of the 15 shells from La Perouse Bank obtained by Mr. Stiles, which are at hand, 9 are fine specimens taken alive and have opercula. Two, including the holotype, have the animals preserved in alcohol; both are females. The remaining 6 are "dead" shells, somewhat worn; one of these is a poorly preserved, half-grown specimen. Thirteen of these shells have the heavy spiral sculpture described for the holotype and are remarkably constant in this outstanding feature, although there are minor variations. Several have all, or nearly all of the smooth nuclear whorls present, which may number from 2 to $2\frac{1}{2}$; they are all somewhat worn, however. Where these are broken off the animal plugs the open hole with shell material, a condition present in the holotype. In several of the better preserved shells, the spiral ribbing continues over the outside of the canal but in diminishing strength, the canal being sculptured with a series of about 9 of these weaker ribs, which are closely spaced and bordered by wider, shallow interspaces. The incised spiral lines on top of the major ribs vary considerably and are absent on some shells.

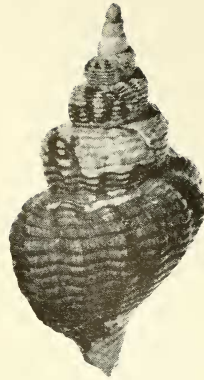
Although a flaring lip seems not to be a feature of the species, in two specimens there is a marked recurving toward the outer edge and in one of these the lip is much thickened and doubled. Color also varies somewhat. The thin periostracum when present, is light brown in some specimens, without the golden hue. One unusually fine fresh shell is a beautiful pinkish-brown color over all. In such fresh shells the color inside the aperture ranges from pink toward a light purple, which evidently changes to lighter flesh or salmon pink with age or exposure to light.

The other two shells in the type lot deviate remarkably from the normal heavily ribbed form. On the the most striking one of these, a "dead" shell illustrated on pl. 3, fig. 2, there is no spiral ribbing whatever on the upper whorls; toward the base of the body whorl, however, a series of four strong ribs bordered by quite narrow channels appears abruptly; the usual series of weaker ribs occurs on the outer canal. Axial sculpture consists of broad, very irregular undulations of varying prominence. Over-all microsculpture appears as the usual closely set growth riblets but these are finely beaded in an axial rather than in a spiral direction. The shell is shorter than normal, with a stubby spire, the summits of the tabulate whorls descending into the sutures, a feature not exhibited in the normal heavily ribbed specimens.

While there is a possibility that this single specimen may be a pathologic variant, the other of the two with aberrant sculpture and other aspects seems perfectly normal. It was collected alive and has the longer spire of the heavily ribbed form from the area; it is illustrated on pl. 3, fig. 3. The heavy spiral ribs are only 7 in number and begin abruptly well below the periphery of the body whorl, with the usual series of weaker ribs on the outer canal. The upper part of the body whorl is sculptured with 6 or 7 weak spiral cords, widely spaced, and bordered by wide, shallow interspaces. At the summit of this whorl is a maze of similarly weak cording, which originates at the suture and extends diagonally to the area where the spiral cords begin. (This feature is suggested also in the figure of *B. marshalli* Dall, 1919, in Bull. 112, U. S. National Museum, p. 91, pl. 9, fig. 3.) The summits of the whorls also show a descending tendency into the sutures. Microsculpture of this shell has been lost due to unfortunate treatment with acid in cleaning it.



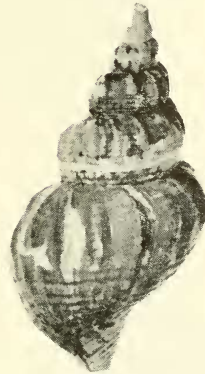
1



2



4



3



5



6

1, *Beringius crebricostatus* (Dall) . 2, 3, *B. kennicotti* (Dall) . 4-6, *B. undatus* Dall.